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A key to the potamidid snails (longbums, mudcreepers and treecreepers) of northern Australia

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Abstract

Longbums and the smaller mudcreepers and treecreepers (Mollusca: Gastropoda: Cerithioidea: Potamididae) are amphibious surface-dwellers of tidal wetlands intimately associated with mangrove forests, depending on the trees for shelter from heat and desiccation, as a substrate, for food, and for protection from predators. A dichotomous key is presented to identify the eight species of Potamididae that occur in tropical northern Australia, several of which have similar looking shells. These species represent 27.6% of the global biodiversity for the family. This contribution describes the most useful features for distinguishing between species, and provides comments on habitat, ecological niche and geographical range of each species, with notes on exploitation by Aborigines. One species of true creeper, *Cerithium coralium* (Cerithioidea: Cerithiidae), is also included because it lives with, and may be easily confused with, juvenile longbums and/or the smaller potamidid species.

Introduction

Since I came to the Northern Territory in 1992, I have fielded more questions about longbums than any other group of molluscs. This might seem strange because they have little commercial significance (though once I saw frozen *Telescopium telescopium* for sale at Casuarina Square Shopping Centre) and their shells lack intrinsic beauty. However, they have huge ecological importance in mangrove forests and in the diets of coastal Aboriginal peoples. I quickly found the taxonomy, anatomy, behaviour and habitats of longbums and other members of the family Potamididae were a source of great interest to a lot of people. I also worked out that there were eight species in tropical northern Australia, constituting 27.6% of the global biodiversity for this family.

The shells of several species of Potamididae look very similar, especially when daubed with mud and/or algal turf, or encrusted with oysters and/or barnacles in the field, so I had to develop a reliable method of distinguishing between them correctly. This method, now refined from experience, is here codified into a dichotomous key together with the latest scientific names for all the species that occur in tropical northern Australia. Keys are not often produced to identify molluscs because, being based on subjective characters that change as the shells grow (ontogenetic

variation), they are extraordinarily hard to generate. Yet keys can be invaluable when they are finally tested and 'foolproof'. I discovered the power of keys for molluscs when I generated one for the intertidal trochid molluscs of the genera *Zediloma* and *Melagraphia* [now all in the genus *Diloma*] in New Zealand (Willan 1980), another group of molluscs that is difficult to distinguish by their shells. Poutiers (1998 pp. 448–449) has published a key to the six potamidid species of interest to fisheries in the western central Pacific Ocean, four of which occur in northern Australia.

The colloquial name longbum is unique to the Northern Territory. Strictly it applies to the four larger members of the family Potamididae (*Telescopium telescopium, Terebralia palustris, Terebralia semistriata* and *Terebralia sulcata*). The name longbum alludes to the long, sinuous trail of faeces left behind an animal after it has been feeding on detritus on the surface of mangrove mud. I have never found out where, or when, the name longbum was first coined. The four other, smaller, species of the family that also occur in northern Australia are known less colourfully as mudcreepers (*Cerithideopsis largillierti* and *Cerithideopsilla cingulata*) and treecreepers (*Cerithidea anticipata* and *Cerithidea reidi*). In other areas of Australia, as elsewhere in the world where they occur, members of the family Potamididae are variously known as mudsnails, mudcreepers, mudwhelks, swamp-ceriths, horn snails, tree-creepers or creepers, and therefore their common names do not distinguish them from the larger species of other families (Cerithiidae, Batillariidae) in the superfamily Cerithioidea, to which they all belong.

The Potamidadae has only been separated from another family of cerithioideans, the Batillariidae, for the past 22 years (Houbrick 1991). This separation is based on two unusual anatomical features (the long style sac and the lack of an oesophogeal gland) and molecular evidence (Reid *et al.* 2008), not shell appearance. Potamidids are different from batillariids, and indeed all other members of the Cerithioidea, by having small mantle papillae and a small feeding organ (radula) (in fact an incredibly tiny radula in *Telescopium telescopium*) with a narrow basal plate on the central tooth, by different sperm structure, and by having a different complement of proteins. The head-foot of potamidids has an extremely long, extensible, often broad snout that has, on either side, a cephalic tentacle with an eye near its base (Figure 1). The foot is moderately short and broad with a pedal gland restricted to the anterior sole margin. The mantle edge is almost smooth and has a light-sensitive pit (a pallial eye) on the underside of the inhalant siphon. The pallial eye in *Telescopium* and *Cerithidea* is highly developed and contains a lens. The gill is relatively small and reduced to a series of fine ridges in *Telescopium*. The oesophagus and the salivary glands pass through the central nerve ring (except in *Terebralia semistriata*, where the salivary glands lie outside the nerve ring). The stomach is very large and superficially resembles that of a bivalve because it has a long sac off to one side containing a solid rod of concentrated digestive enzymes (a crystalline style). The sexes are separate. Males lack a penis and instead bundle their sperm into flower-like packages

Figure 1. An adult Lesser Longbum *Terebralia palustris* has extended its head-foot from its shell and is rasping a fallen mangrove leaf, Ludmilla Creek, Darwin Harbour. (Neil Wright)

(spermatophores); those of *Terebralia sulcata* are by far the most elaborate of any cerithioidean. Females have a well-developed, elongate ovipositor on the right side of the foot (that could be mistaken for a penis!). The spawn consists of numerous eggs laid in gelatinous strings. The young hatch as free-swimming larvae that feed on phytoplankton (Healy & Wells 1998) and Houbriek (1991) inferred a long duration for the larvae in the plankton.

Potamidids are detritivores, sweeping up fine algae and detritus with a radula that emerges at the end of the long, flexible proboscis. *Terebralia palustris* is unique in changing the shape of its teeth prior to maturation allowing it to switch its diet from detritus as a juvenile to rasping freshly fallen mangrove leaves as an adult. This adult diet brings it into competition with mangrove-dwelling sesarmid crabs (Salgado-Kent & McGuinness 2008). Interestingly, populations of *T. palustris* occur in southeastern Arabia without mangrove leaves, and even survive in sheltered habitats elsewhere without any mangrove trees (Feulner 2000; Reid *et al.* 2008), so presumably these individuals must subsist on detritus for their entire life.

Despite relatively good published information about the anatomy of potamidids, I have been very surprised by how mueh remains to be discovered about the functional morphology, behaviour, physiology and ecology of these eommon molluscs. For example, we do not know what triggers sexual maturation or spawning, how long the larvae remain in the plankton, or what induees them to settle out of the plankton. Importantly, no researeh has been condueted on growth rates, longevity

of adults, or resilience to harvesting of the edible species (Willan & Dredge 2004). Buckworth (1995) prepared a draft strategy for management of such 'data-deficient' fisheries using modelling based on *Telescopium telescopium*.

What is very clear though is that potamidids have a very close and very long association with mangroves (Glaubrecht 1996), appearing to depend on the trees for shelter, as a substrate, for food and for protection from predators (Reid *et al.* 2008). The Potamididae, in addition to one family of bivalves, the Glauconomidae (R.C. Willan, unpubl.), exists exclusively among mangroves and their suite of tidal habitats (Reid *et al.* 2008). As demonstrated by a molecular phylogenetic analysis [incorporating material from Darwin Harbour that I provided] in combination with a survey of fossil specimens, the oldest modern genera (*Terebralia* and *Cerithideopsis*) first appeared in the Tethyan realm in the Mid-Eocene shortly after the origin of mangrove trees (Reid *et al.* 2008). Modern potamidids represent a single adaptive radiation that diversified in this newly created mangrove environment (Reid *et al.* 2008). Even the specialised tree-climbing taxa are mangrove obligates, and so are part of this radiation. Only those potamidid species of the genus *Cerithideopsilla* that have secondarily lost their association with mangroves, have been able to colonise temperate coastlines where mangroves do not occur.

Aboriginal people in coastal nothern Australia consume only two species of longbum – *Telescopium telescopium* (regularly) and *Terebralia palustris* (less often). However, longbums were never a dietary staple, as were bivalves (Meehan 1992). This may be because longbums have a very low protein content (Meehan 1992). Furthermore, it is said their somewhat peppery taste increases the desire for drinking (Poutiers 1998). In Asia, as elsewhere in Australia, longbums are consumed after light roasting, or steaming or boiling. Also in Asia, longbums and other mudcreepers are sometimes used as bait (Meehan 1992) and the shells (of the larger, thicker species) are utilised for making lime (Poutiers 1998).

Dichotomous key to potamidid snails of northern Australia

The following dichotomous key is based on easily visible external shell characters. This key relates to 'typical' adult shells, so atypical shells (i.e., those that have been eroded by the naturally acidic sediments they inhabit) and juveniles may not always key out correctly. The key contains prompts such as "look carefully" at difficult junctions to help make the correct choice. Additional information that can be helpful in making the right choice is given in square brackets. It will still be difficult on some occasions to distinguish between some shells of the three species of *Terebralia* and to distinguish *Cerithideopsilla cingulata* from *Cerithium coralium*, particularly when dealing with worn or immature shells. A representative shell of a Lesser Longbum *Terebralia sulcata* is illustrated to explain the features used in the dichotomous key (Figure 2). To support this key, shells of all the species are shown in Figures 3–11. I have selected these shells as being 'typical' of their species.

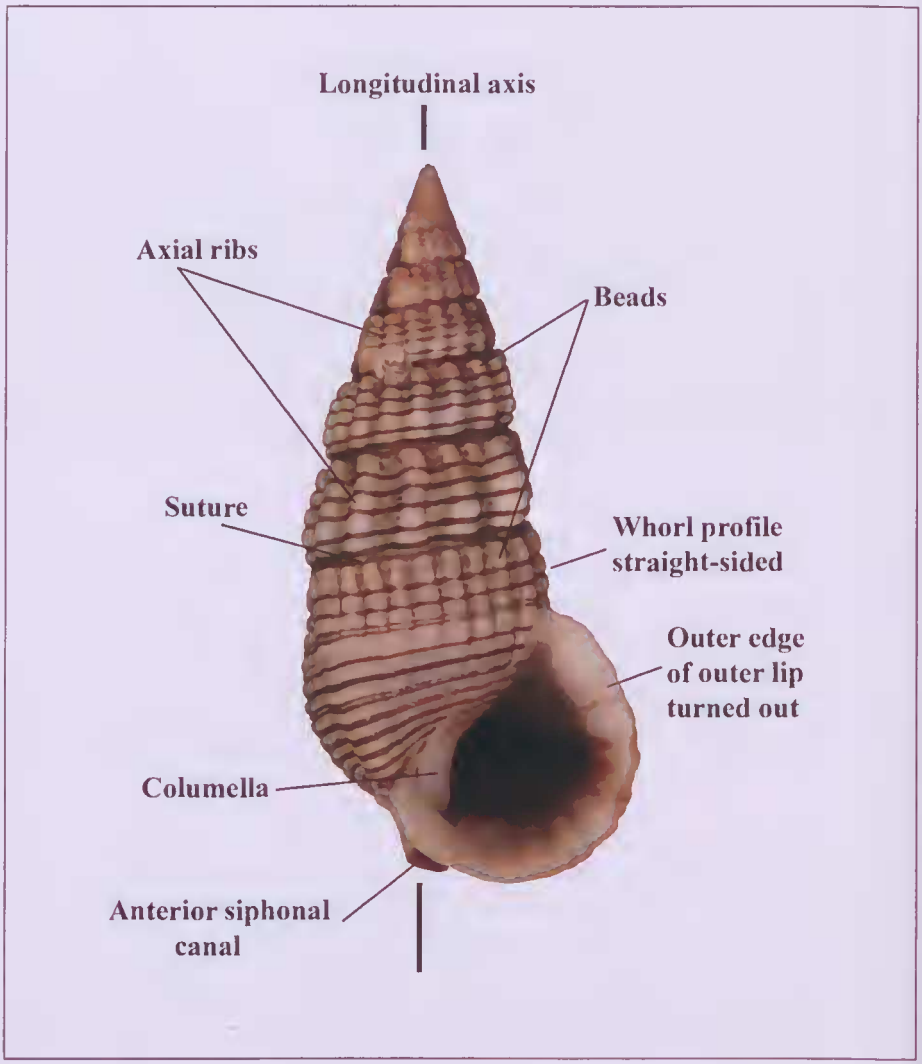

Figure 2. Ventral view of a shell of Lesser Longbum *Terebralia sulcata* to illustrate the characters mentioned in the dichotomous key. (Régis Martin)

Key to potamidid snails of northern Australia

1a. Fold present on columella of shell ..... *Telescopium telescopium*

1b. No fold on columella of shell 2

2a. No ribs aligned with longitudinal axis of shell (axial ribs); maximum size of shell less than 15 mm ..... *Cerithideopsilla cingulata*

2b. Ribs aligned with longitudinal axis of shell present at least towards apex of shell [look carefully]; maximum size of shell greater than 15 mm 3

3a. Shell surface lacks beads (in rows or otherwise) [but surface ornamentation may include axial ribs] 4

3b. Ornamentation on surface of shell includes rows of beads [may overlay axial ribs] 6

4a. Whorls very rounded (convex) in profile; strong axial ribs consistently present from apex to at least penultimate whorl ..... *Cerithideopsis largillierti*

4b. Whorls straight-sided; weak axial ribbing, if present, only on apical third of shell and/or on body whorl 5

5a. Suture wavy [due to row of beads immediately below it]; adult shell with open (spout-like) anterior siphonal canal ..... *Terebralia palustris*

5b. Suture straight; adult shell with closed (circular) anterior siphonal canal ..... *Terebralia semistriata*

6a. Outer edge of outer lip strongly crinkled at margin, not turned out; maximum length of adult shell less than 28 mm ..... *Cerithium coralium*

6b. Outer edge of outer lip smooth at margin, turned out; maximum length of adult shell greater than 28 mm 7

7a. Columellar wall concave; body whorl evenly rounded [apex typically present and shell relatively thick] ..... *Terebralia sulcata*

7b. Columellar wall vertical (i.e., aligned with longitudinal axis of shell); body whorl squared off basally [apex typically broken off and shell thin] 8

8a. Axial ribs narrow (i.e., the majority separated by interspaces at least twice their width); maximum length of adult shell less than 40 mm ..... *Cerithidea anticipata*

8b. Axial ribs broad (i.e., roughly equal in width to interspaces); maximum length of adult shell greater than 40 mm ..... *Cerithidea reidi*

Comments on individual species

Longbum *Telescopium telescopium* (Figure 3)

The 'true' Longbum grows to about 100 mm shell length. *Telescopium telescopium* is the only member of the family to have a fold on the columella and it is further distinguished by its very thick shell, aperture tangential (perpendicular) to the shell's longitudinal axis, straight-sided whorls and even sculpture of small spiral cords. *Telescopium telescopium* lives on the ground in the middle section of mangrove forests or mid-tidal flats. Animals are shy to any movement and quickly retreat into their shells whenever approached (Houbrick 1991). Animals are only active when exposed by the tide. Interestingly, in Indonesia *T. telescopium* lives in a similar zone to northern Australia, but in mud so soft that it is nearly liquid. In these substrates, animals burrow into the mud as the incoming tide covers them, taking a semi-vertical position just below the surface (Budiman 1988). Aspects of the ecology of *T. telescopium* in northern Australia have been investigated by Lasiak and Dye (1986) and Wells (1986). The highest densities of *T. telescopium* have been recorded in the mid-tidal flat of mangrove forests in Darwin Harbour (Metcalfe 2007) where, in association with *Terebralia semistriata*, they are highly abundant on the shaded mud surface beneath the dense *Ceriops* canopy. *Telescopium telescopium* has an extensive distributional range throughout the tropical Indo-west Pacific Ocean. On the Australian continent it extends from Onslow in central Western Australia, around the northern coast to Bowen in central Queensland. *Telescopium telescopium* is the only species of the family that is regularly consumed by Aborigines.

Lesser Longbum *Terebralia palustris* (Figure 4)

This species grows to a maximum shell length of 120 mm, though Loch (1987) recorded an exceptionally large specimen from Arnhem Land with a shell length of 190 mm. *Terebralia palustris* is characterised by the wavy suture, strong varices, and adult shell with an open (spout-like) anterior siphonal canal. *Terebralia palustris* lives on the ground in the hinterland margin and mid-tidal flat of the mangrove forest, and also occasionally on the banks of tidal creeks where the substrate is relatively well consolidated (Wells 1980). It is the only species of the family to switch its diet as it grows; juveniles eat detritus like all other potamidids, but as they become adult they start to consume fallen mangrove leaves. This change of diet (trophic dimorphism) corresponds to a change in the shape of the teeth in the radula. *Terebralia palustris* has a very extensive distributional range throughout the tropical and warm-temperate Indo-Pacific Ocean. On the Australian continent it extends from Shark Bay in central Western Australia, around the northern coast to Townsville in northern Queensland. *Terebralia palustris* is sometimes collected and consumed by Aborigines along with *Telescopium telescopium* but as it tastes much more peppery than *Telescopium telescopium*, particularly at some times of the year, so it is often discarded live at the site of consumption on land where it eventually dies from desiccation (R.C. Willan, unpubl.).

Lesser Longbum *Terebralia semistriata* (Figure 5)

This species, which grows to about 75 mm shell length, is characterised by the expansion of the outer lip anteriorly in adults to close the anterior siphonal canal from a spout into a circular hole, straight-sided whorls, broad flattened spiral cords, and straight suture. Juveniles are particularly difficult to separate from those of *T. sulcata*. Two features that often assist correct identification are the possession by juvenile *T. semistriata* of a relatively thicker shell and broad dark spiral colour bands. Like *Telescopium telescopium*, *Terebralia semistriata* lives on the ground in the middle section of mangrove forests. In Darwin Harbour it is characteristically very numerous in the *Ceriops*-dominated mid-tidal flat, but only rarely found in the hinterland margin and tidal creek habitats. *Terebralia semistriata* is almost restricted to northern Australia with a range from North West Cape in central Western Australia, around the northern coast, to Keppel Bay in central Queensland. There is also a population at Merauke in West Papua. *Terebralia semistriata*, along with *Terebralia palustris*, is sometimes collected by 'novice' Aborigines in conjunction with the desired *Telescopium telescopium*, but *Terebralia semistriata* is highly peppery and is always discarded at the eating place (R.C. Willan, unpubl.).

Lesser Longbum *Terebralia sulcata* (Figure 6)

This, the smallest species of *Terebralia*, which only grows to about 60 mm shell length (but 50 mm is more usual), is characterised by the expansion of the outer lip anteriorly in adults to close the anterior siphonal canal from a spout into a circular hole, moderately convex whorls, straight suture, and strongly beaded spiral cords where they intersect the axial ribs; the resulting strong sculpture is notable and resembles weaving on a basket. The aperture and the body whorl are much-expanded in proportion to the remainder of the shell. The topmost whorls of the shell are often naturally broken off (decollated). *Terebralia sulcata* lives on firm ground in the lower intertidal section of mangrove forests, most often amongst the densest tangle of prop roots of *Rhizophora stylosa* or the pneumatophores of *Sonneratia alba* and *Avicennia marina*. Individuals often climb onto *Rhizophora* roots. *Terebralia sulcata* has a very extensive distributional range throughout the tropical and warm-temperate Indo-Pacific Ocean. On the Australian continent it extends from Shark Bay, central Western Australia, around the northern coast, to Torres Strait. *Terebralia sulcata* is never consumed by Aborigines.

Reid's Treecreeper *Cerithidea reidi* (Figure 7)

This species, which grows to about 60 mm shell length, is characterised by its thin shell and broad axial ribs that are strongly beaded (the strongest row of beads is immediately below the suture), and its purple-brown aperture. The apical part of the shell of adults is always naturally broken off (decollated), an adaptation to reduce the weight of the shell. *Cerithidea reidi* lives on the hinterland margin of mangrove


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Figures 3–11. Representative shells of Potamididae (longbums, treecreepers and mudcreepers) plus the Mudflat-dwelling Creeper (Cerithiidae) from northern Australia. All specimens are from the mollusc collection at the Museum and Art Gallery of the Northern Territory: **3.** Longbum *Telescopium telescopium*, 82.7 mm; **4.** Lesser Longbum *Terebralia palustris*, 119.4 mm; **5.** Lesser Longbum *Terebralia semistriata*, 72.8 mm; **6.** Lesser Longbum *Terebralia sulcata*, 48.8 mm; **7.** Reid's Treecreeper *Cerithidea reidi*, 53.6 mm; **8.** Obtuse Treecreeper *Cerithidea anticipata*, 36.9 mm; **9.** Largillierť's Mudcreeper *Cerithideopsis largillierti*, 34.1 mm; **10.** Mudflat-dwelling Creeper *Cerithium coralium*, 26.6 mm; **11.** Banded Mudcreeper *Cerithideopsilla cingulata*, 13.1 mm. (Régis Martin)

forests where it climbs the trunks of (several species of) mangrove trees. *Cerithidea reidi* is the only Australian endemic species in the family with a range restricted to Western Australia, from North West Cape along the western coast to Admiralty Gulf in the Kimberley region. *Cerithidea reidi* is never consumed by Aborigines.

Obtuse Treecreeper *Cerithidea anticipata* (Figure 8)

This species, which was called *Cerithidea obtusa* in the older Australian literature, grows to about 40 mm shell length. It is characterised by its thin shell and narrow axial ribs that are weakly beaded. The apical part of the shell is always naturally broken off (deccollated), an adaptation to reduce the weight of the shell. The absence of an apex gives the shell a somewhat obtuse appearance. *Cerithidea anticipata* lives in the hinterland margin and the mid-tidal flat of mangrove forests and also in saltmarsh environments, often occurring in extremely high densities amongst the foliage of the canopy (Metcalfe 2007). *Cerithidea anticipata* is rarely found on the ground, mainly foraging low on trunks of (several species of) mangrove when conditions are suitably moist, but it remains quiescent in the upper canopy during the drier months (McGuinness 1994). When resting on tree trunks, *C. anticipata* attaches by dried mucus, with only a small part of the flanged outer lip in contact with the trunk. Individuals cluster preferentially on the more shaded side of the trunk around the fringe of clearings. McGuinness (1994) showed experimentally that individuals climb higher and are less active during neap tides than during spring tides. This observation led McGuinness (1994) to conclude that this species [and, by extrapolation, other treecreepers] climbs primarily to avoid physiological stress during neap tides, rather than to avoid subtidal predators during spring tides. *Cerithidea anticipata* has an extensive distributional range throughout the tropical western Pacific Ocean. On the Australian mainland it is found from Admiralty Gulf in northern Western Australia, around the northern coast to Moreton Bay in southern Queensland. *Cerithidea anticipata* is never consumed by Aborigines.

Largilliert's Mudcreeper *Cerithideopsis largillierti* (Figure 9)

This species, which grows to about 35 mm shell length but is often smaller, is characterised by its relatively thin shell, very convex whorls and strong smooth axial ribs. Its colouration is variable, and it can be banded or uniformly chestnut-brown. *Cerithideopsis largillierti* lives on the ground in the middle to lower-tidal sections of mangrove forests where the mud is softest and it always remains in shallow pools when the tide is out. *Cerithideopsis largillierti* has an extensive distributional range throughout the tropical western Pacific Ocean. On the Australian maninland it ranges from the Kimberley region of northern Western Australia, around the northern coast to northern Queensland. *Cerithideopsis largillierti* is never consumed by Aborigines.

Banded Mudcreeper *Cerithideopsilla cingulata* (Figure 11)

This species (more probably a complex of as many as 14 cryptic species) (D. Reid, pers. comm.), which grows to about 15 mm shell length but is often 10 mm or less, is the smallest member of the family worldwide. It is characterised by the spiral rows of beads that do not align axially, by the absence of an anterior canal, and by the expansion of the outer lip posteriorly into a flaring, wing-like process. Its colouration is variable. *Cerithideopsilla cingulata* lives on the ground in a variety of habitats and substrate types – on the hinterland margin of mangrove forests, on the margins of tidal creeks and saltmarsh and adjacent tidal flats and saltpans, and also on sheltered muddy sandflats not fringed by mangroves (R.C. Willan, unpubl.). In fact, it rarely lives amongst the mangrove trees themselves so it is actually the only member of the family Potamididae in Australia capable of existing outside mangrove forests. It can be extremely abundant where it occurs; for example Poutiers (1998) cited a density of 500 m^2. *Cerithideopsilla cingulata* has an extensive distribution throughout the tropical western Pacific Ocean. On the Australian mainland, its range is from Dampier in central Western Australia, around the northern coast to Moreton Bay in southern Queensland. *Cerithideopsilla cingulata* is far too small to be consumed by Aborigines.

Mudflat-dwelling Creeper *Cerithium coralium* (Figure 10)

Though shell length in adults is highly variable (Houbrick 1992), this species can grow to a maximum of 28 mm. It is one of the few species of the extremely large family of true creepers (Cerithiidae) to live in mangrove environments (Houbrick 1992), or on any soft intertidal substrate. Houbrick (1992 p. 66) had no doubt that the presence of mangrove forests is a critical factor in its distribution. Therefore, when it occurs with juvenile longbums and/or other species of mudcreepers in these habitats it is easily confused with them. In such habitats the shells of all the cerithioidean species are usually dark brown, highly eroded, and convergent in general shape and sculpture and, as Houbrick (1992) observed, the problems of identification are compounded by the mixing of shells of different taxa between habitats by hermit crabs. *Cerithium coralium* is characterised by its tall, tapering,

dark brown shell comprising straight-sided whorls each sculptured with three aligned spiral rows of beads, the spindle-shaped aperture with a thickened parietal callus, the deep anal canal, the longish and deflected anterior canal, and by the strongly crinkled margin of the outer lip. *Cerithium coralium* can live on a wide range of intertidal estuarine habitats – from the seaward fringe of mangrove forests to the soft bare mud on sheltered shores not bordered by mangroves. Though it and *Cerithideopsilla cingulata* exist naturally at opposite zones of mangrove forests, they can occur together at the water line on very protected sloping beaches and brackish lakes. Both species are particularly common in Darwin's Lake Alexander, which is a brackish lake. *Cerithium coralium* lives in areas of high organic content and is a deposit feeder (Yipp 1980), so it competes with *Cerithideopsilla cingulata* where they occur together. Despite intensive surveys of mangrove forests over the last decade, observers have only two records of this species from a range of sites in Darwin Harbour. Both were from the seaward or *Sonneratia* zone (Metcalfe 2007, 2010). *Cerithium coralium* has a moderate distributional range throughout the tropical western Pacific Ocean centered around the continental margins and large archipelagos. On the Australian continent it ranges from Shark Bay in central Western Australia, around the northern and eastern coasts supposedly to Sydney Harbour in central New South Wales. Beechey (2012) notes that the Sydney Harbour records relate to only a few specimens collected in the nineteenth century. However, there appears to be a living population in Manly Lagoon just north of Sydney, and the species becomes more common northwards from there. *Cerithium coralium* is never consumed by Aborigines.

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